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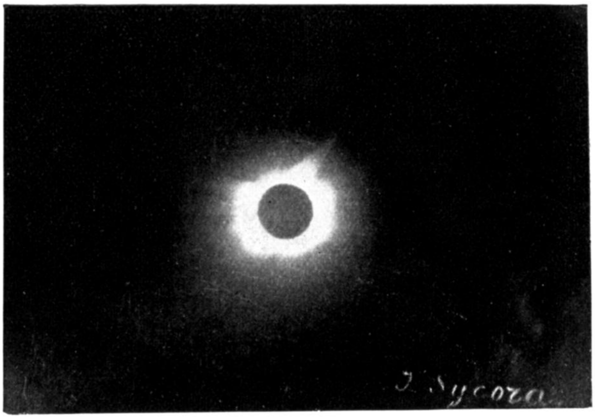
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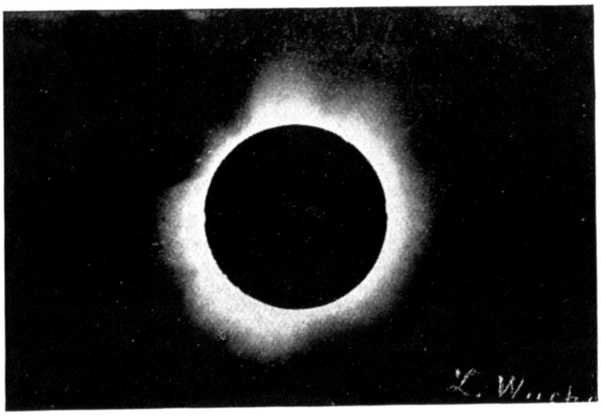
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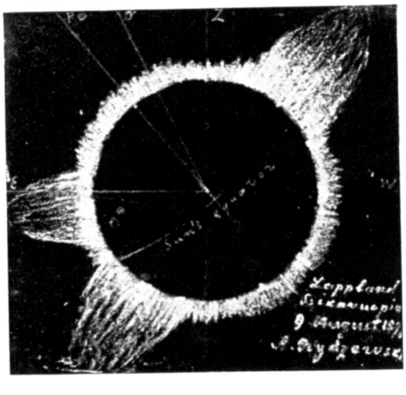
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THE TOTAL ECLIPSE OF AUGUST 9, 1896.

By Alexander Rydzewski.

The Russian Astronomical Society organized two expeditions for observing the total eclipse of the Sun of August 9th of this year. One was stationed at the village of Tshekurskoje on the Lena, near Olekminsk, in Siberia, and another at Siikavuopio,* on the right (Swedish) bank of the river Muonio. At first the society intended to send the last expedition to Iitto, a little village on the left bank of the Muonio in Finnish Lapland; but the difficulties of transporting the luggage of the expedition to this place, and also the shorter distance of Siikavuopio from the line of central eclipse, forced a change in the first plan.

Thinking that it will be interesting to the members of the Astronomical Society of the Pacific to learn some particulars of the expedition to Siikavuopio, I intend, as a member of this expedition and also as a member of the A. S. P., to give a brief sketch of our journey to Siikavuopio, and of our observations during the eclipse.

The *personnel* of this expedition was as follows: L. G. Wuchikhowsky, an experienced astronomer, who possesses an observatory at Belkawe, near Winzig, in Silesia; I. I. Sycora, an astronomer from Charkow, whose last paper, concerning the variability of the Sun's diameter, was remarked by the scientific world; General-Lieutenant Baron N. W. Kaulbars; and myself.

The expedition possessed the following instruments: (1) seven-inch Merz telescope, equatorially mounted, moved by hand, and with a revolving camera, the system of which was proposed by the Russian physicist, W. W. Lermantoff; (2) four-inch Merz lens, loaned to the expedition by the Board for providing Russian state papers, with a photographical camera attached to it, equatorially mounted, and also moved by hand; (3) 2.4-inch Fraunhofer's telescope; (4) 1.8-inch Steinheil's and Zeiss' photographic lens, with camera; (5) a photographic apparatus with film-ribbons for sixty-four photographs, loaned to Baron N. W. Kaulbars, by the photographical firm Nyblin, in Helsingfors; (6) 1.2-inch Kern's universal instrument for determining geographical positions; (7) Frodsham mean-time chronometer; (8) ERICSON mean-time chronometer; (9) WIREN mean-time chronometer (of decimal system); (10) FRODSHAM sidereal-time chronometer; (11) an aneroid by NODÉ, loaned to the expedition by General A. A. TILLO; (12) a STEPHAN'S compass; (13) a PISTOR and MARTIN'S reflecting-circle, with an artificial mercurial horizon.

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* The coördinates of the station were: Longitude, 1h 26m 37s E.; Latitude, 68° 37′ 27″.

We left St. Petersburg (Messrs. WUCHIKHOWSKY, SYCORA, and myself), after making all the necessary preparations, July 8th, at 9 o'clock A.M., by the Finland railway, and at 9 o'clock P.M. of this day at the railway station, Richimiaki, we met the fourth member of our expedition, Baron N. W. KAULBARS, who came from Helsingfors.

The railway journey to Oulu (Swedish Uleaborg) was very pleasant and comfortable. I cannot omit here to mention the courtesy of the Senate of Finland, who arranged for a free passage for all the members of the expedition, and for free transport of the astronomical and domestic luggage. We arrived at Oulu on July 9th, at 9 o'clock P.M. The Sun at this hour of the day was yet high, and illuminated the very pretty but small town of Oulu, which is situated on the shore of the Gulf of Bothnia. This town, notwithstanding its smallness (it has only 10,000 inhabitants), is illuminated by electric light, and has the telephone also. In the United States that is not a rare thing, but here much larger towns have neither telephone nor electric light.

We left Oulu by the steamship "Pahjola," July 10th, at half-past six in the morning. The day was fine and sunny; no wave disturbed the smooth surface of the Gulf of Bothnia. After twelve hours' journey, we arrived at Tornea, a little town which belongs to Finland, and is situated on an island near the mouth of the river Torneo, in the Gulf of Bothnia. Opposite, on the right coast of Torneo, is situated the Swedish town Haparanda, known to all the world as one of the most northern meteorological observatories (+ 65° 50′ latitude). At Torneo we spent two days in making astronomical observations for geographical position, and we left this town, July 9th, at nine o'clock in the evening. Our carriages were a kind of dog-carts, mostly used in Finland, but not very convenient for transporting a luggage so bulky as our instruments. In these dog-carts we made our journey to Kolari during three nights; traveling at night because the days were too hot. During the daytime we slept at very pretty and clean post-stations.

July 13th, about eleven o'clock in the evening, we passed near the mountain Avasaksa, which is yearly visited about the twenty-first of June by innumerable tourists from different parts of the world, coming here to observe the Sun, which does not set during three days about this date. Although Avasaksa is situated south of the polar circle, its height (172 metres) compensates for the difference of latitude. The road from Torneo to Kolari is very hilly, and the constant climbing and descending wearied our horses immensely. As an additional annoyance we were attacked by an innumerable army of mosquitoes, about whose ferocity in this country we had heard before starting from home.

The fifteenth of July, we came to Kolari, a little village on the shore of the river Muonio. From this place our journey to Siikavuopio, the final point of our voyage, had to be made in boats. On the morning of July 16th, all the boxes containing our instruments and equipment were loaded into boats—six in all; after that we placed ourselves in the boats, on the boxes, and commenced our long journey on the river Muonio. The unusual mode of traveling requires a detailed description of the boats themselves, as well as of the mode of propulsion. The flat-bottomed boats are about eight yards long, one yard wide, and the distance between the gunwale of the boat and the surface of the water, when the boat was loaded, was only three and a half inches. The boats are propelled by three boatmen, one on the prow and two on the poop, who move the boat against the current by means of pushing-poles three and a half yards in length. This mode of propulsion is particularly difficult in the rapids, which on the Muonio river were encountered by dozens every day. In these places our boatmen were so tired by propelling the boats, that they were literally soaked with perspiration, and after an hour's hard work they were obliged to rest and to renew their strength with coffee. Muonio's shores are very picturesque, particularly near the rapids, but the flora is not rich; the pine disappears totally by the village Ilimuonio (latitude 68° 0′), the fir by Kuttainen (latitude 68° 23′); in the more northern parts of Lapland the wiry birches of small size are the sole representatives of trees. We encountered during our journey very few polar reindeer, although they are quite common in that country; they are usually sent in summer by their owners to graze in the mountains. The weather during our journey through Muonio was variable; sometimes it rained the whole day, sometimes the Sun burned us from morning till night, when we stopped for rest in the very clean and comfortable villages situated on the shores.

July 24th, the last day of our journey to Siikavuopio, was very cold. The wind was blowing from the mountains, which were covered in several places with snow lying in the hollows; where it never melts, not even in the midst of summer. We came to Siikavuopio the same day at 6 o'clock P. M., and at once selected a suitable place for observing the coming eclipse: it was the hill Siikavaara, whose height is about ninety-five yards above the level of Muonio, situated about a mile from our lodging in Siikavuopio. We could not begin the installation of the instruments at once for want of wood for making supports, and we were obliged to wait till it was brought from a locality farther south. In the mean time Mr. SYCORA observed the Sun near the meridian and near the prime vertical, and I computed immediately from his observations the latitude and the corrections of the chronometer; Baron KAULBARS made a detailed plan of Siikavuopio, with its neighborhood; and Mr. WUCHIKHOWSKY arranged the photographic dark-room and adjusted his telescope to photographic focus by taking several photographs of the Moon. At last the wood arrived at Siikavuopio, and we began to make the necessary installation of the instruments.

The meridian lines for all the instruments were determined by the Sun: all our astronomical observations in Siikavuopio were made by the Sun, because our universal instrument was so small that no star, even of the first magnitude, could be seen with it on such a bright sky as that of Siikavuopio till the middle of August, when even at midnight the Sun is only 7° 30′ below the horizon.

On August 5th all was ready, and on August 6th, at the same hour at which the eclipse would occur on August 9th, we made at Siikavaara a rehearsal of our coming observations. On this day, at 4 o'clock A. M., when we started from our lodging to Siikavaara, there was a frost, the only one experienced during our sojourn in Lapland.

The weather in Lapland is very variable, which, I suppose, can be explained by its position directly in the path of cyclones traversing Europe towards the northeast; but, on the whole, fine weather prevails there. It is a pity that no meteorological observatory is established in this region (neither in Sweden nor in Finland), and therefore we have no regular records of the weather in this part of Lapland.

The eve of the long-expected day was rainy, and we lost all hope of seeing the eclipse; but in the evening the weather began to improve. The clouds broke in several places, which constantly grew, and with their growing we began to have more hope. We went to sleep at eleven, but, as is easily conceived, we could not sleep, and we skipped from our beds every ten minutes to see if the heavens were clearing or not.

At 2 o'clock A. M., of August 9th, we were already up, and started at once for our observatory on Siikavaara.

The sky to the north and northeast, and particularly at the place where the observations were to be made, was quite clear, although the rest of the sky was covered with small passing clouds. We were joined on the mountain by all our boatmen and by all the inhabitants of Siikavuopio, so that the people on the mountain, during the eclipse, amounted to one-and-thirty men and three women in all. There never were before, and there never will be again, so many people in such a wild region as Siikavaara. We placed ourselves beside our instruments: Mr. WUCHIKHOWSKY at the seven-inch MERZ photographic telescope, Mr. SYCORA at the four-inch photographic MERZ telescope.* Baron KAULBARS prepared himself for photography with two cameras (without equatorial mounting), and I stood beside the 2.4-inch FRAUNHOFER telescope to make by its help a drawing of the corona and the prominences.

This was not the first eclipse observed by Baron KAULBARS, Mr. WUCHIKHOWSKY, and myself. We had been participants in different expeditions organized by Russia in 1887 for observing the eclipse of August 19th; but the weather then had been unfavorable for the former two gentlemen. I had been lucky enough to belong to the party of Professor GLASENAPP, who secured observations on the line of central eclipse, at a little town, Petrowsk, where the weather was more propitious. Although the sky was covered with clouds, it was yet possible to observe the corona through them, because they were sufficiently thin.

At $4^h\ 27^m\ 0^s$ (M. S. T.) the first contact took place, and the Sun began rapidly to disappear behind the Moon. No such strange and beautiful coloring of the clouds as I had remarked during the eclipse of 1887 was observed before totality. Several seconds before the second contact, Mr. WUCHIKHOWSKY cried "Beads," but they were seen by no other member of the party.

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*To that telescope the spectroscope and another four-inch telescope for eye observations were attached; but Mr. SYCORA had no time during the short duration of the eclipse to make observations other than photographic.

At $5^h\ 21^m\ 39^s$ (M. S. T.) the totality began, but no trace of the corona was seen in the field of my telescope. Thinking I had moved the telescope. I gazed at the sky with the naked eye and immediately saw the extremely bright corona, and when I looked again in the telescope the corona was just in the middle of the field of view. The corona appeared smaller and not so bright as viewed with the naked eye, but its particularities were very well seen, on the other hand. Five large prominences (one of them double) of a light rose tint surrounded the very dark body of the Moon; two of the prominences were mountain-like, three column-like, one of the last being double. The top of the higher of the two was curved to the north. At the northwest of the corona I observed one coronal streamer; one at the east; and one at the southeast. The radial structure of these streamers was very evident, whilst at the eclipse of 1887 no such structure could be observed at Petrowsk. The color of the corona was silver-white, with no greenish tinge such as has been observed during some eclipses by several astronomers; nor was a greenish tinge seen during the eclipse of 1887. Several seconds before third contact, which was at $5^h\ 23^m\ 20^s$ (M. S. T.) the chromosphere appeared, and soon after that the first ray of the Sun flashed out, and the sublime spectacle was ended. It had lasted one hundred and one seconds.

Twenty-two photographs of the corona and of the crescent Sun were obtained before the totality and during it: Mr. WUCHIKHOWSKY photographed five coronas and four crescents; Mr. SYCORA, three coronas and three crescents; and Baron KAULBARS (with two cameras), three coronas and four crescents. On several photographs of Sun's crescents made by Mr. WUCHIKHOWSKY a thin mist encircling the crescent is to be observed; but it was so thin that none of us observed it either with telescopes or with the naked eye. I suppose that this mist was due to the rapid falling of the temperature, which led to the condensation of the moist air just in the path of the cone of shadow.

The temperature before the first contact of the eclipse was 4° C.; ten minutes after that contact it fell to 3° C.; during the totality the thermometer was not observed, but as the temperature ten minutes after totality was only 2° C., it may be supposed that during the totality it was not higher than 1° C.

Thinking that the readers of this brief description of the eclipse of August 9th will be interested in seeing the photographs and the drawing of the corona, I add to my article five illustrations of the corona:

(1) One of four seconds exposure, photographed with the seven-inch telescope by Mr. WUCHIKHOWSKY.*

(2) Two photographed with the four-inch telescope by Mr. SYCORA; one of fifteen seconds of exposure, another of twenty seconds.*

(3) One with landscape, photographed with the ordinary photographic camera by Baron KAULBARS.

(4) My drawing of the corona, as observed by the 2.4-inch telescope.*

To illustrate our observatory, and our instruments, I add also a photograph of the top of the mountain, Siikavaara, taken by Mr. WUCHIKHOWSKY, about an hour after the totality.

The same day most of our photographic plates were developed by Mr. WUCHIKHOWSKY; the development of the remaining plates was put off until our return to St. Petersburg.

We left Siikavuopio August 12th, after our bulky luggage was packed.

The return homewards was far swifter than our journey to Siikavuopio, because the current of Muonio, and particularly its rapids, helped us, now, instead of hindering as was the case before.

On August 20th, we parted with Baron KAULBARS at Richimiaki; Mr. WUCHIKHOWSKY left us at Perkijarvi; and Mr. SYCORA and myself arrived together the same evening at St. Petersburg. Such was the end of our interesting and fortunate expedition (compared with the unlucky expeditions to Vadsö and Japan) to Lapland, which was carried out in such friendly company as can never be forgotten by me.

ST. PETERSBURG, October 7th, 1896.

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* See the plate accompanying.